be surprised at the alleged unhealthiness of Cyprus, when Mr. Wyld tells us that the average temperature in February is 52·8° *Centigrade*, and that of July and August 82° of the same scale!

LIEUT. KITCHENER, R.E., has handed over to the Committee of the Palestine Exploration Fund the whole of the memoirs, special plans, and lists connected with the great map of Western Palestine. These materials, now in the hands of the Committee, consist of a map in twenty-six sheets, on the scale of one inch to a mile; a map in three sheets, on the scale of three-eighths of the large map; and an immense collection of memoirs from the note-books of Lieut. Conder and himself. The Committee have already taken steps for the publication of the maps, and will at once proceed to consider that of the memoirs, a part of the work as important as the map. Lieut. Kitchener exchanges the work of the Palestine Fund for the important charge of the survey of Cyprus, to which he has been appointed by the Foreign Office. He achieved in Palestine what may be called the unparalleled feat in survey work of surveying 1,000 square miles for 1,000*l.*, and in eight months.

WE learn from Washington that Capt. Tyson is expected in America with the *Florence* in which last year he made a preliminary trip, with the view of establishing a polar colony at Lady Franklin's Sound. The scheme, which has been devised by Capt. Howgate, of the Signal Service, has not been given up, but postponed for one year, Congress having terminated its session without any resolution having been taken on the necessary grant of credit. It will be proposed again when the Congress meets in 1879, and the report drawn up this year by the special commission will receive an additional force from observations taken by Capt. Tyson and his able scientific staff.

THE *Geographical Magazine* for September describes the equipment of two expeditions from the United States for the survey of the Amazon. One of these is in the *Enterprise*, under Commander Selfridge, of the U.S. Navy, which will survey the river as far as Manaos, and the Madeira as far as San Antonio, the point of departure of the line of railway around the Falls of Madeira. The other expedition is sent out by Messrs. Mackie and Scott, of Philadelphia, its object being to arrange a route by way of the large rivers which connect Bolivia and Brazil, over which trade can be carried on. As a preliminary measure a surveying party will go to Bolivia to study the country, and will be accompanied by a naturalist, Mr. Ernest Morris, who has already done good work on the Lower Amazon.

THE just published June number of the *Bulletin* of the French Geographical Society contains M. de Ujfalvy's account of his official journey to Zarafshan, Ferganah, and Kuldja, which contains a good many original ethnological observations. Dr. Hamy has a paper on Manoel Godinho de Eredia, the Portuguese whom Mr. Major and others had accepted as the earliest discoverer of Australia; fuller evidence, however, convinced Mr. Major that Godinho had no claim to this honour, and Dr. Hamy endeavours to show what were the real services rendered by this "Descobrider" to geography. The number contains the letter from Savorgnan De Brazza, describing his journey on the Ogové, to which we alluded some time since.

FROM the *Bollettino* of the Italian Geographical Society we learn that Romola Gessi had been furnished with a formidable equipment for the exploration of the Sobat, by Gordon Pasha, who, at the last moment, was compelled to stop the expedition, on account of a formidable rebellion in Darfur.

M. PAUL SOLEILLET, who, it will be remembered, was to cross Africa from Senegambia to Algeria, reached Kuniakaro on June 23 by way of Bakel. This was 1,250 kilometres beyond St. Louis, and thitherto M. Soleillet had few difficulties. After Kuniakaro, however, the real work of the expedition will commence, and not a few dangers will have to be faced. His next point was Yamina, a small town on the banks of the Joliba, about 50 kilometres from Segou.

LETTERS have been received in Holland from the members of the Dutch North Polar Expedition, and their contents are said to be highly interesting. The expedition, after leaving Bergen, had proceeded to Jan Mayen, where they arrived on May 9. On June 27 they reached Amsterdam Island, where a simple monument was erected in memory of the Dutch sailors buried there. The expedition then visited the other principal points of Spitzbergen, and eventually sailed for Vardö, on the north coast of Norway. It was then their intention to cross the Barentz Sea in order to reach Novaya Zemlya in the middle of August. The letters state further that numerous scientific observations have been made.

DR. GERHARD ROHLFS, after finding that his efforts to form a large society with a view of organising an exploring expedition to Africa upon a grand scale, have not met with the success he anticipated, has now resolved to start alone as on former occasions.

AT the meeting of the French Geographical Societies in Paris a number of resolutions were adopted, bearing principally on the teaching of geography and topography in the public schools, the creation of regional geographical museums and congresses, the means of multiplying the number of geographical societies, and fostering intercourse between members of the several European societies. It was decided that all the members of the different French and Algerian societies should have the right to be admitted to each others meetings. It was proposed to advise foreign societies to do the same, and to adopt an universal geographical society's ticket. The next national geographical exhibition will take place at Montpellier in 1879, on the occasion of the meeting of the French Association. A conference of all French societies will also be held at the same time.

THE gold medal for English maps, charts, &c., at the Paris Exhibition, has been awarded to Mr. Stanford.

BREWING IN JAPAN

AT the present time, when the history of the origin and development of the lower forms of life is occupying a great deal of attention, any facts which increase our knowledge of the growth of such bodies should be welcomed. In our breweries the growth of the yeast-ferment is tolerably well understood, or, at least, has been well observed and described. Under ordinary conditions the yeast-fungus exists only in the aquatic form, as it may be termed; and only under special circumstances, and with considerable difficulty in preventing putrefaction, is it enabled to produce spores. The internal substance of the cell becomes differentiated; granulations form and collect round certain points, and these ultimately become invested with a membrane, upon which the spores are ripe. The production of spores is thus unattended with the formation of a mycelium, or, if formed, it is so minute as to have been overlooked. This, however, is not a normal process of reproduction: the principal one, and indeed under the usual conditions, the only mode, is by budding.

Those living in Japan, however, have the opportunity of seeing a mode of fermentation which differs in many particulars from that employed in Europe. The subject is now under investigation, and at present I am not able to explain accurately what takes place; but as the process followed is interesting from its novelty, as it appears to consist in the previous practical use of a discovery

made by De Bary, and afterwards confirmed by Rees and by Fitz, that alcoholic fermentation can be effected by the growth of a species of *Mucor*, I am induced to give an account of a visit made, in company with some scientific friends, to the saké breweries situated about thirty miles away from Tokiô, the capital of Japan.

Saké is the general name given to the alcoholic liquid prepared by the fermentation of rice. There are many varieties of it prepared in different parts of Japan, each receiving some special name, either derived from the district in which it is prepared, or from some fancy of the manufacturer. It is a clear liquid, of a colour varying from the palest yellow to that of the darkest sherry, and containing from twelve to fifteen per cent. by weight of alcohol. There are some special kinds which contain much less alcohol—from four to five per cent—but they do not form the usual drink of the Japanese. It is almost always served hot, being placed in porcelain bottles, which are immersed in hot water and left there until the whole has attained the proper temperature.

This liquid is prepared on the large scale only in certain parts of the country, the most famous district being that near Ôzaka, one of the Treaty Ports. It is, however, often prepared on the small scale in private houses. The winter is the only season during which brewing operations are conducted, but this is not because the fermentation temperature is to be kept low as in the Bavarian method, but, I believe, in order to prevent the action becoming too tumultuous, for the temperature of fermentation is, in reality, even higher than that adopted in England. But, from the fact that the largest breweries are situated nearly 400 miles from Tôkiô, and the operations being carried on during a period when the University session is at its height, I have been compelled to confine my inquiries to the smaller breweries at Hachiôji, near this city.

The main room consists of a large wooden building about 120 feet long by 50 feet broad, and 25 to 30 feet high, running along the middle of which, in the direction of its length, is a platform about 12 feet from the ground, upon which some of the preliminary operations are carried out. Upon this a number of wooden tubs are placed, which serve for the preparation of the ferment, an operation which requires to be repeated several times during the brewing season. On the ground, ranged along the two long sides of the building are large tuns used for the storing of the saké when made, and some of which are also used for the actual processes of fermentation.

The brewing commences with the preparation of the ferment. For this purpose at the end of the previous brewing season a quantity of a green mould is produced upon rice by exposing steamed rice mixed with a certain proportion of the ash of some tree, and over which the spores of this fungus have been scattered in a well-closed chamber, which I may term the "fungus-chamber." This is a small room about 7 ft. high by 6 ft. broad, and 8 ft. long, well lined and covered with straw and matting, so that its high temperature may be kept up for a considerable time. In this chamber the rice and spores are left for about ten days, the atmosphere being kept quite moist by the vapour given off from the steamed rice, and at the end of that time the grains are found to be covered with a green fungus full of spores, and apparently the same kind as is found growing upon putrefying organic substances. The temperature of the chamber when examined was 25° C., that of the external atmosphere being 13° C. This product is called, in Japanese, *tane* or seed.

When prepared at the end of the season it is preserved until the next by being placed in bags, and inclosed in wooden boxes between layers of a mixture of equal parts of lime and wood-ashes.

When it is required to commence operations, a similar method is adopted to that just described, that is, a quantity of steamed rice is placed on wooden trays in the "fungus-chamber," but not mixed with any wood-ashes, and then *tăné* (spores) is scattered over it, and the chamber kept closed for a period varying from two to four days. At the end of this time the rice-grains are found to be covered with large quantities of fine hair-like threads, the mycelium of the fungus added. In this state it is called "kōji."

If this were left for a longer period in the fungus-chamber, it would produce spores, and the brewer calls it "the friend of tane," but in order to carry on the development of the mycelium most vigorously, it is necessary to use wood-ash in addition, which thus seems to act as a fertiliser.

Having thus obtained the "kōji," or mycelium, the brewer uses it for effecting the preparation of his yeast. For this purpose he mixes steamed rice with 30 per cent. of its weight of "kōji" and a sufficient quantity of water to make a thick mud, in small shallow wooden tubs, which are kept on the platform previously mentioned. In these it is frequently stirred and rubbed round with wooden tools, during a period of about ten days, in the course of which the grains of rice appear to be broken down, and the whole assumes a much thinner consistence, while at the same time the liquor becomes decidedly sweet. This is a change which is anything but clear; it would seem that it is connected with the development of an organism derived from the "kōji;" as on the small scale, I have noticed the production of minute cells, apparently budding, but whether they have any connection with the air-fungus, the mycelium of which covers the rice in "kōji;" or whether they have been developed from germs accidentally present in the "kōji," I am not able to say, though I hope that further experiments will make this point clear.

After the end of the ten days this product is mixed with fresh-steamed rice, water, and "kōji," and introduced into larger wooden vessels, in which the mixture is heated by means of closed wooden tubs, containing hot water, and in order to prevent too rapid radiation, the whole is covered with matting. The hot-water tubs are replaced day by day, so that the temperature is kept up for a period varying from eight to thirteen days. The average temperature seems to be about 35° C. (95° F.). During this time there is a continuous development of gas, and a scum gradually forms upon the surface until it has a thickness of a little more than one inch, and, when examined under the microscope, presents the usual appearance of brewer's ferment—saccharomyces. At the end of this stage, if the operation has been well conducted, five tastes are to be distinguished: sweet, bitter, astringent, alcoholic, and sour; but of these five, all of which are quite distinct, the bitter, astringent, and sour tastes are most marked. The product of this operation is called "moto," which means "source" or "origin," referring to the fact that it is from this ferment that the saké is subsequently formed. All the previous part of the brewing process has thus had for its object merely the preparation of the yeast, but it is certainly the most interesting, from the obscurity which surrounds it.

The actual fermentation is divided into three stages, called respectively *beginning*, *middle*, and *end*, the proportions of steamed rice and ferment varying slightly in each stage, but giving a final result of 100 parts of steamed rice to 30 parts of ferment. This mixture, together with the proper quantity of water, is placed in one of the large tuns before mentioned, and allowed to remain for about fifteen days in all, during which time fermentation actively proceeds, and the liquid becomes strongly alcoholic, at the end of which time it is drawn off from the grains of rice which have subsided, and introduced into other tuns, where it is allowed to remain to permit the remainder of the rice to be separated. The residue is placed in bags and subjected to pressure in a

lever press, the clear liquid which is expressed being added to that which has been clarified. It is now placed in boilers and heated up to about 60° C., after which it is kept in the store vats, carefully sealed up.

The residue left in the press is subjected to a process of distillation in a current of steam, by which a spirit containing about 42 per cent. of alcohol is obtained.

The saké in the store vats contains about 15 per cent. of alcohol, and this fact shows that the fermentation is different to that effected by the *Mucor racemosus*, as described by Fitz. In his experiments he found that the presence of 4½ to 5½ per cent. of alcohol killed the ferment, whilst in the process above described, we find the ferment acting in such a way as to produce 15 per cent. There is, however, nothing improbable in the supposition that different species may possess different degrees of sensitiveness to alcohol, and that the species used here may be less easily affected than the one employed by Fitz.

There are, however, many points about the process which are obscure, and about which I cannot say anything at present, but further experiment will, it is hoped, throw light upon the obscurity now enveloping the subject. The above account has been given in the hope that it may prove of some interest to those engaged in the study of fermentation, and that it may lead to a more extended examination of the action of various species of fungus upon amylaceous substances.

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THE ORIGIN AND DISTRIBUTION OF ORGANIC COLOUR

COLOUR, throughout the realms of organic nature, is a factor hitherto held to be the most capricious in its distribution and the least amenable to any finite law. So uncertain and variable indeed are its manifestations that its claims for the purposes even of specific diagnosis have long since been ignored by the comparative anatomist. Nevertheless, when examined more attentively, an amount of evidence may be adduced sufficient to warrant further inquiry as to whether there is not existent beneath the superficial stratum of apparent disorder, a harmonious under-current indicative of a derivation in the abstract from one of nature's simplest physical laws, namely, that of polarisation.

Directing brief attention first to the subject of colour as distributed among the animal world, it will at once be recognised that, with few exceptions, it is only amongst the classes lower in the scale than the mammalia that this element either attains or retains its full exuberance. Even within such limits it will be further found that the beautiful and recently-discovered law of natural selection, for the purposes of concealment or protection, has in many instances so influenced and subordinated all pre-existing characters as to have entirely masked or eliminated them. The lepidopterous order of the class Insecta most prominently illustrates this latter case; the brilliant and varied hues of many members of this tribe being, as has been ably demonstrated, more especially by Mr. Alfred R. Wallace, in accord either with the flowers they most frequent, the objects upon or adjacent to which they rest in repose, or, still more remarkably, mimetically identical with those of other perfectly distinct species which owe their immunity from the attacks of birds to their peculiar acrid flavour.

The types among which have been first observed those peculiar colour-characteristics now to be submitted, are more particularly associated with aquatic life, and from these latter it has been found possible to extend and institute comparisons amongst almost every terrestrial group. Reference is here made to the dominance among the animal types in question of those so-called "complementary colours" familiar to all acquainted with the working of the polariscope. Of these colours in question, the combinations red and green, and blue and yellow are the most important, and it is surprising to find how frequently these reproduce themselves in nature.

Enumerating on this occasion merely a few instances, reference may be first made to those forms in which blue with its complementary hue, yellow, are found associated. Blue, as a rule, enters but to a comparatively trifling extent into the coloration of our indigenous fish fauna, but a remarkable and very gorgeous exception is afforded by the male of the Cuckoo Wrass (*Labrus mixtus*), which in its adult condition is resplendent with equally-distributed tints of the purest azure and most brilliant orange. These same complementary hues of blue and yellow obtain again in the male of another British fish, known as the Gemmeous Dragonet (*Callionymus lyra*). A conspicuous exotic example of the same colour-combination is presented by the Tesselated Parrot Fish of Ceylon (*Scarus hariæ*), characterised by its groundwork of azure blue decorated with an hexagonal network of golden yellow. Among the invertebrate division of the animal kingdom, the class of the Crustacea affords several interesting instances of a similar combination. Two of these belonging to the Decapodous order, *Galathea strigosa* and *Scyllarus arctus*, are of considerable size, having the deep orange hue of the general surface of their carapace variegated with bands and markings of brilliant blue. The Common Lobster (*Homarus vulgaris*), again, often "sports" into a bright blue variety, variously spotted and mottled with yellow. The legs of the Common Prawn (*Pandalus annulicornis*) are also most usually decorated with alternating rings of blue and orange. The marine copepods, more especially those of tropical seas, abound with instances of the association of these same two complementary hues. The class of the Mollusca is one among which blue as a pure colour but very rarely presents itself. There are, however, two Nudibranchs (*Goniodoris cœlestis*, Desh., and *G. elegans*, Cantraine) conspicuous for their ground colour of azure, accompanied in each instance by spots or lines of yellow. The last-named and finer of these two species, attaining a length of 2½ inches, and usually classed as a Mediterranean type, was collected by the writer on the rocky shore of the Cies Islands, Vigo Bay, in association with the dredging expedition of Mr. Marshall Hall's yacht *Norna*, during the spring of the year 1871.

Pursuing the investigation among terrestrial types, the bird tribe—although it is necessary here to cite almost entirely tropical forms—produces abundant instances of the association of the same blue and yellow tints. The large Blue and Yellow Macaw (*Ara ararauna*) of South America forms a most conspicuous illustration, and the same two complementary hues will be found coupled together among innumerable other representatives of the parrot tribe, and likewise among the toucans. The most exquisitely beautiful blue bird yet known to science, the Azure Cæreba (*Cæreba cyanea*), is not altogether deficient of the complementary tint of yellow, several feathers of this colour appearing in the wings. One of the Cassowaries (*Casuarius kaupi*, Sclater), as figured in the Zoological Society's *Proceedings* for the year 1872, is represented as having the skin of the upper and front portion of the throat coloured azure-blue, while immediately behind and adjacent to this succeeds a patch of bright yellow. A still later and highly characteristic example is likewise afforded by the newly named *Euphonia insignis* of Messrs. Sclater and Salvin, figured at Pl. lii. Fig. 1 of the third part of the same *Proceedings* for this current year. Although our indigenous avifauna produces very few species in which the colour blue occupies a prominent position, the little Blue Tomtit (*Parus cœruleus*) is an exception which at the same